Natural Resources Canada | Ressources naturelles Canada

Canadian Forest Service Update to NASA ABoVE

NASA ABoVE Science Meeting
Seattle. 22.05.2019
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Canada

Natural Resources Canada
Canadian Forest Service (CFS)

Provides science and policy expertise and advice on national forest sector issues, working in close collaboration with the provinces and territories.

Growth and Innovation: Rooted in Sustainable Forests

Priorities:

- Support forest sector competitiveness
- Optimize forest value
- Advance environmental leadership

- >600 staff; ~70 research scientists

CFS research portfolio

CFS research portfolio

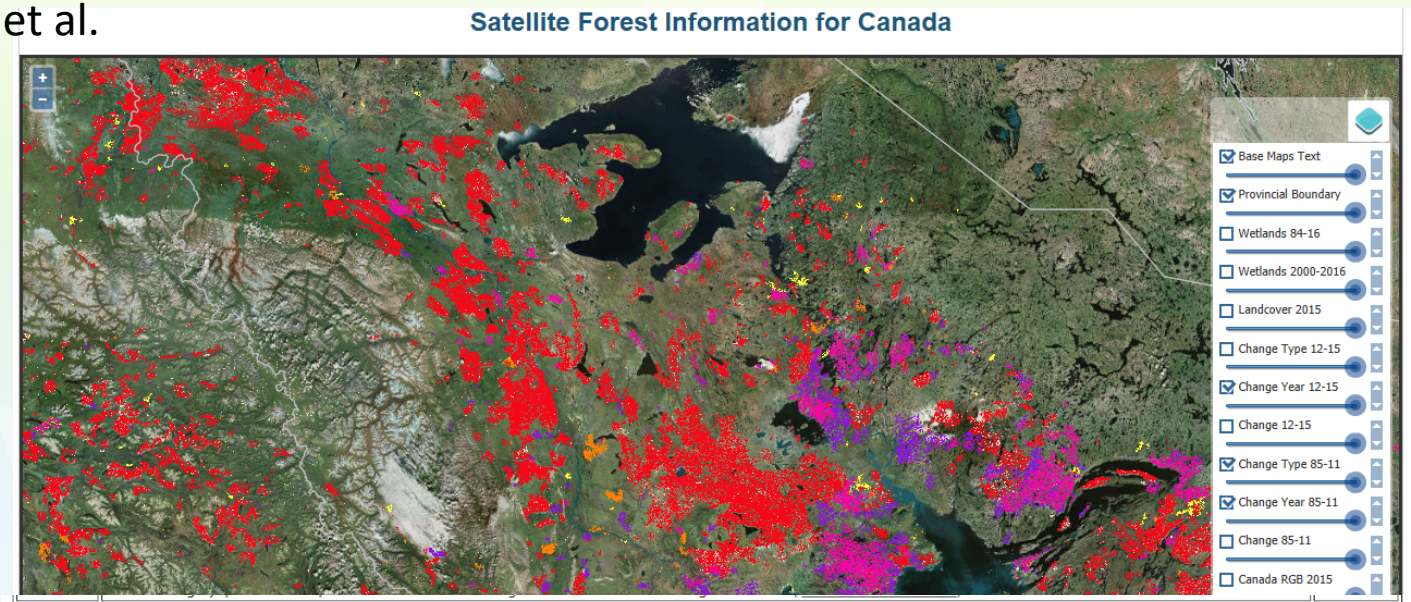
Good news!!

The North is now a cross-cutting top priority for CFS

Nation-wide forest change data

https://opendata.nfis.org/mapserver/nfis-change_eng.html

Wulder et al.



Change Type 85-11	Forest Change Type (Wildfire, Harvest, Low Confidence Wildfire, Low Confidence Harvest). The forest change data included in this product is national in scope (entire forested ecosystem) and represents the first wall-to-wall characterization of wildfire and harvest in Canada at a spatial resolution commensurate with human impacts. The information outcomes represent 25 years of stand replacing change in Canada's forests, derived from a single, consistent spatially-explicit data source, derived in a fully automated manner. This demonstrated capacity to characterize forests at a resolution that captures human impacts is key to establishing a baseline for detailed monitoring of forested ecosystems from management and science perspectives. Time series of Landsat data were used to characterize national trends in stand replacing forest disturbances caused by wildfire and harvest for the period 1985-2011 for Canada's 650 million hectare forested ecosystems (White et al. 2017). Landsat data has a 30m spatial resolution, so the change information is highly detailed and is commensurate with that of human impacts. These data represent annual stand replacing forest changes. The stand replacing disturbances types labeled are wildfire and harvest, with lower confidence wildfire and harvest, also shared. The distinction and sharing of lower class membership likelihoods is to indicate to users that some change events were more difficult to allocate to a change type, but are generally found to be in the correct category. For an overview on the data, image processing, and time series change detection methods applied, as well as information on independent accuracy assessment of the data, see Hermosilla et al. (2016)). When using this data, please cite as: White, J.C., M.A. Wulder, T. Hermosilla, N.C. Coops, and G.W. Hobart. (2017). A nationwide annual characterization of 25 years of forest disturbance and recovery for Canada using Landsat time series. Remote Sensing of Environment. 192: 303-321.(White et al. 2017). Hermosilla, T., M.A. Wulder, J.C. White, N.C. Coops, G.W. Hobart, L.B. Campbell, (2016). Mass data processing of time series Landsat imagery: pixels to data products for forest monitoring. International Journal of Digital Earth. 9. (Hermosilla et al. 2016).	Change type 1985-2011 (GeoTif, 249MB),

Remote Sensing and Forest Management in NWT

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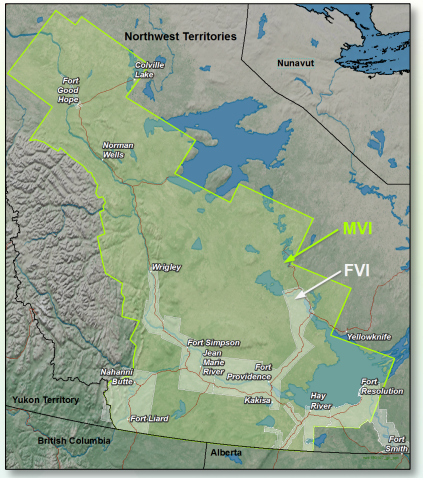
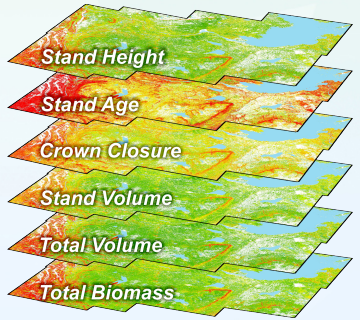
Long-standing collaboration to derive a large area forest inventory c. 2010 in the Taiga Plains ecozone considerably extending FVI:

- Inventory includes maps in both polygon (2 ha min size) and raster (30 m pixel size) formats of forest type, stand height, tree cover, stand volume, biomass and stand age.
- A portion of the 200+ forest inventory plots established for this purpose are being remeasured by GNWT and are now part of the network of PSPs in NWT.
- The maps can/are used by GNWT to: (1) plan the development of a forestry industry in NWT; (2) identify areas for salvage logging after fire and potential timber harvesting; (3) enhance the NWT Ecological Land Classification; and (4) inform habitat suitability mapping and analysis (e.g., caribou).
- A remapping exercise for c. 2020 is planned, pending funding.





Remote Sensing and Forest Management in NWT

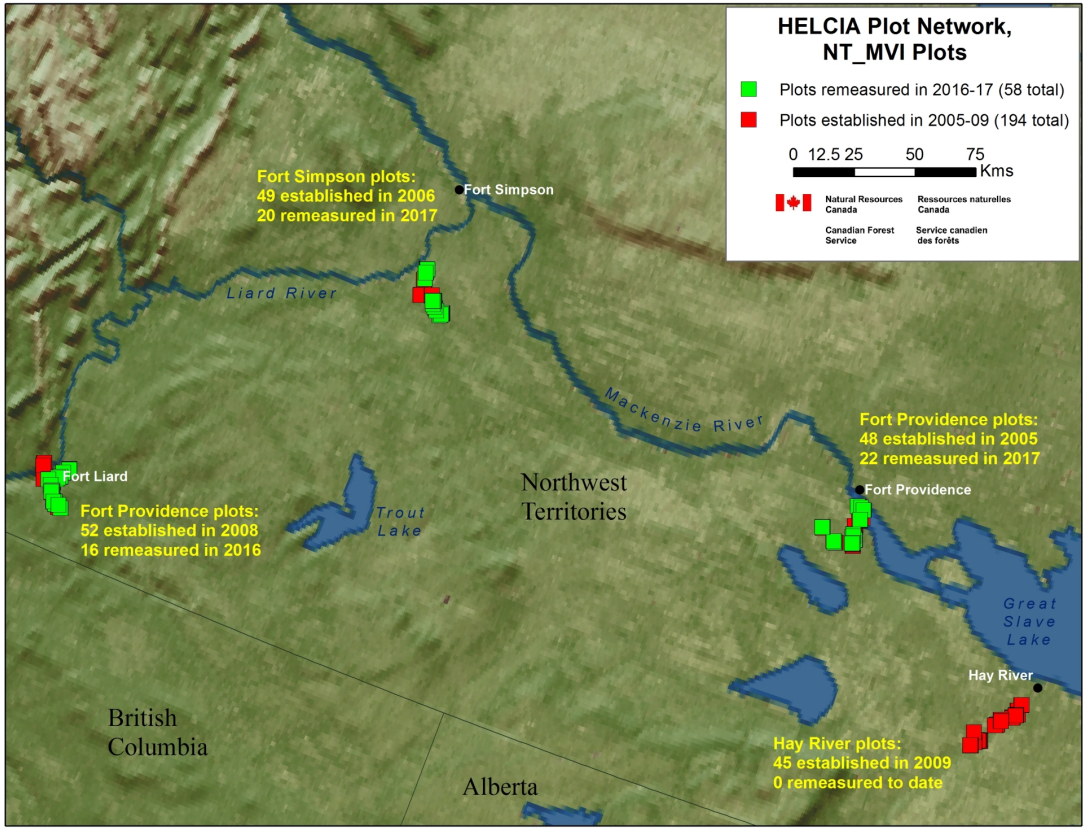
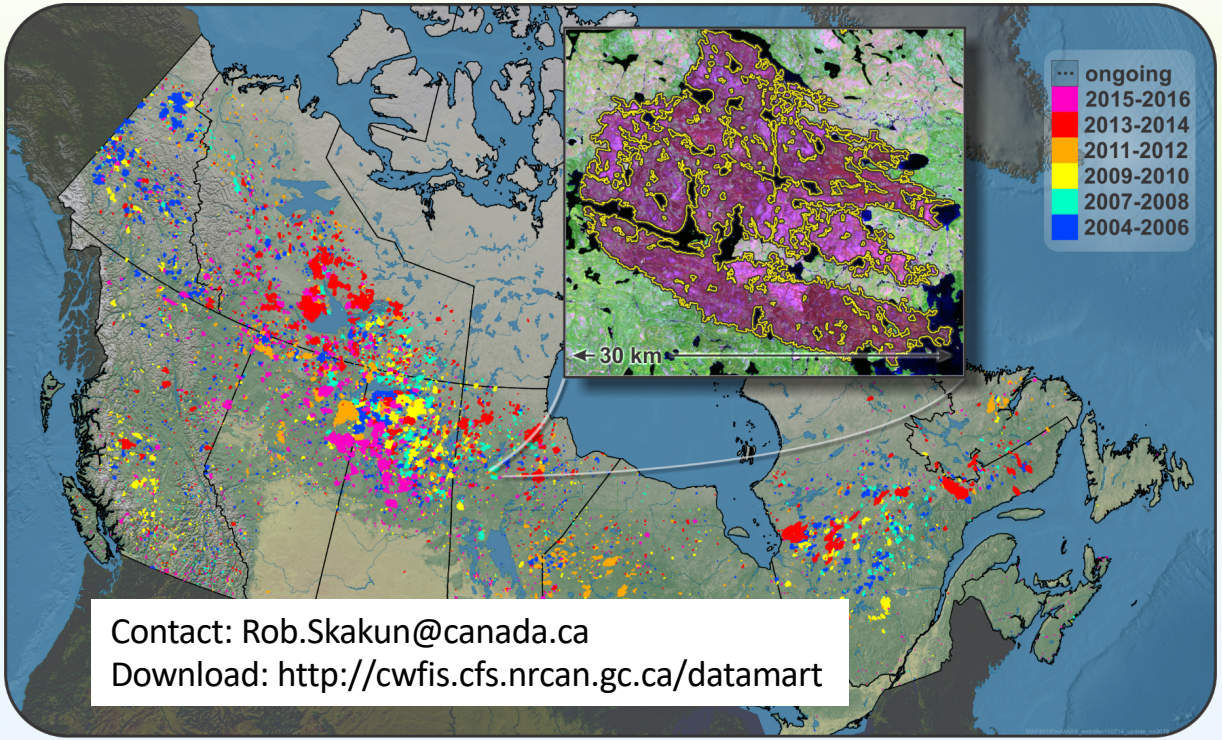


Photo by: Roger Brett

2019 plans:
45 plots in Hay River area,
30 plots in Ft. Liard area

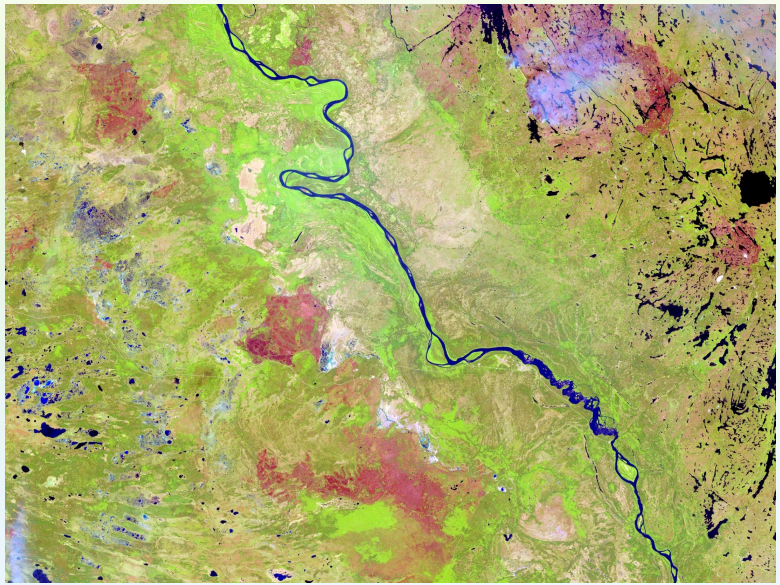
Mapping Fires: National Burned Area Composite: 1986-2018 (Castilla, Skakun)



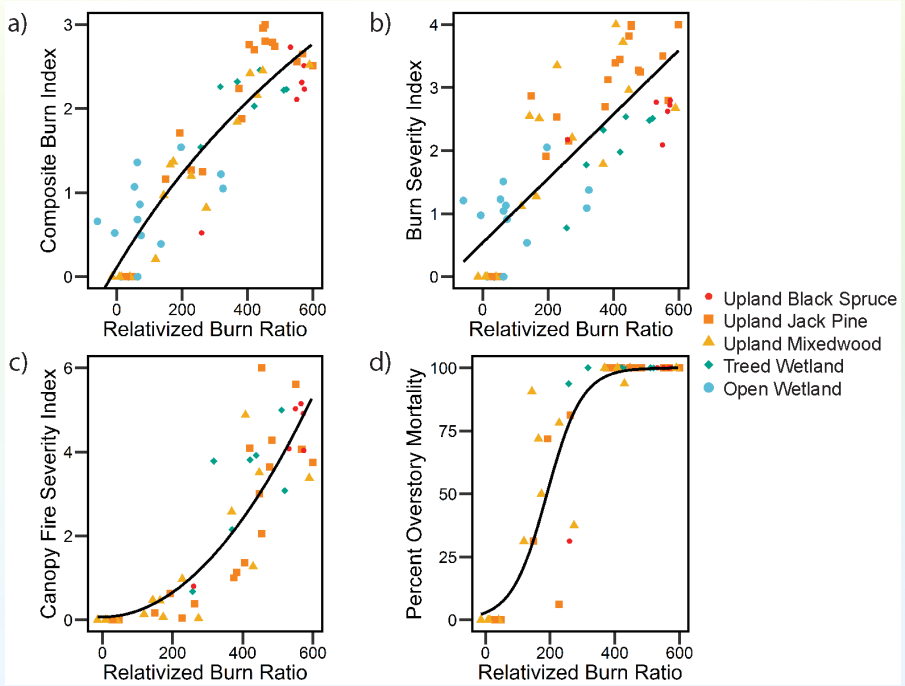
Contact: Rob.Skakun@canada.ca
Download: http://cwfis.cfs.nrcan.gc.ca/datamart

Remote Sensing of Burn Severity

Ellen.Whitman@canada.ca



Landsat multispectral satellite imagery



Whitman et al. 2018. Ecosphere.

National wildfire fuels mapping

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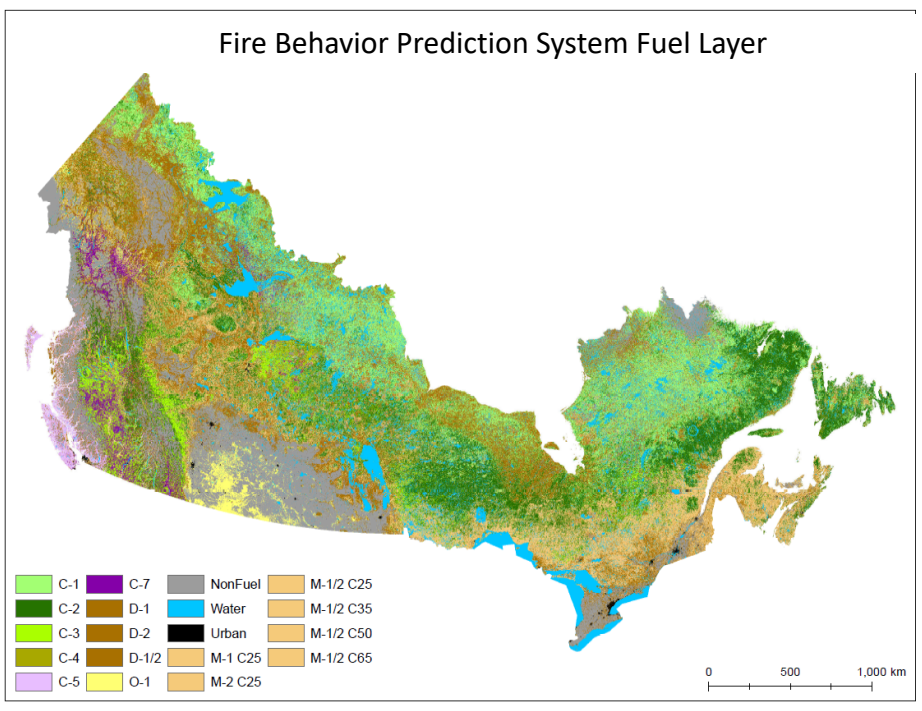
- Canadian Forest Fire Danger Rating System
- Algorithm to convert vegetation or forest inventory data into fuel load and structure
- National fuels maps derived from national forest inventory kNN maps
- Future updates (NWT-specific MVI)



Parameters for Fuel Type Estimation

Current FBP:

- Height
- Crown closure/density
- Leading species
- Percent conifer
- Disturbance history (slash fuels and spruce budworm only)
- Elevation

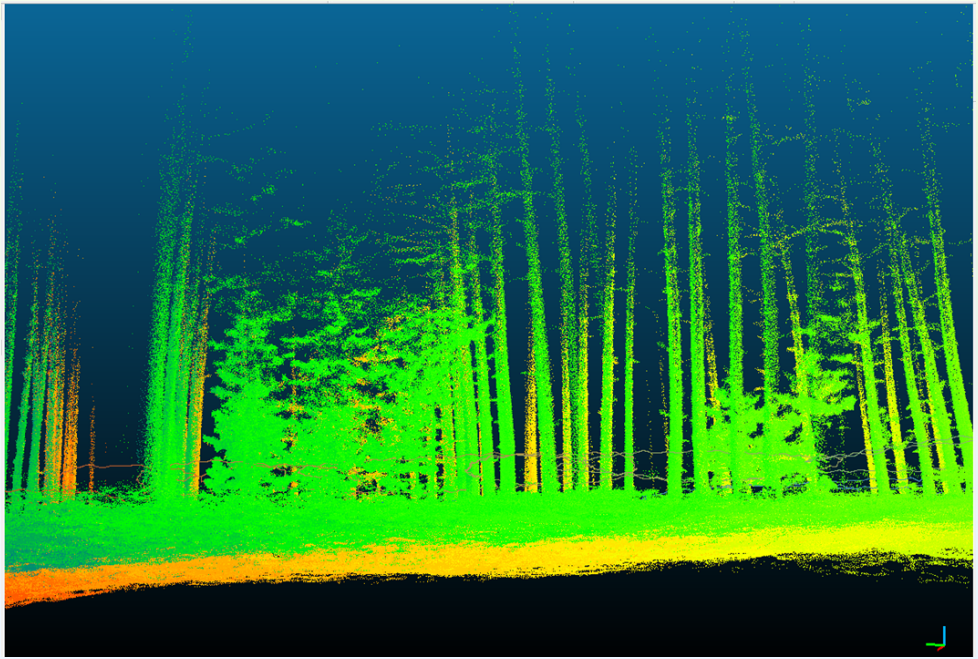
Possible Future FBP:

- Crown base height (m)
- Canopy bulk density (kg/m^3)
- Shrub layers
- Surface fuel type:
  - Dry needle
  - Needle and moss
  - Lichen
  - Sphagnum
- Surface fuel load (kg/m2)

National wildfire fuels mapping

Terrestrial LiDAR

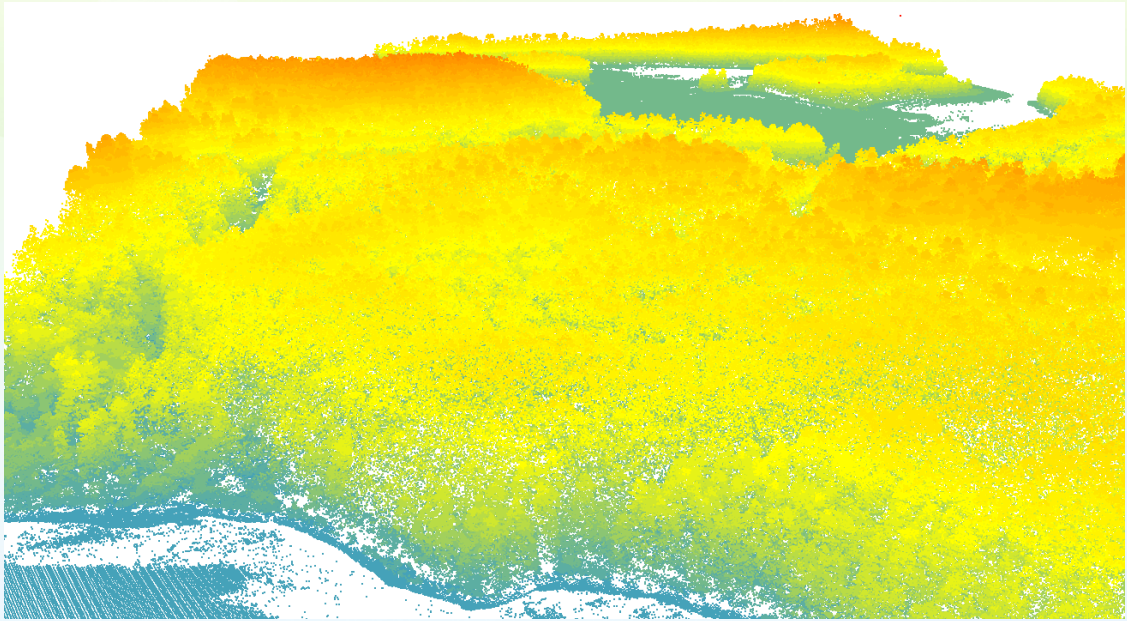
- Direct estimate of fuel load
- Detailed stand structure and stem mapping
- Replace field measurements?



National wildfire fuels mapping

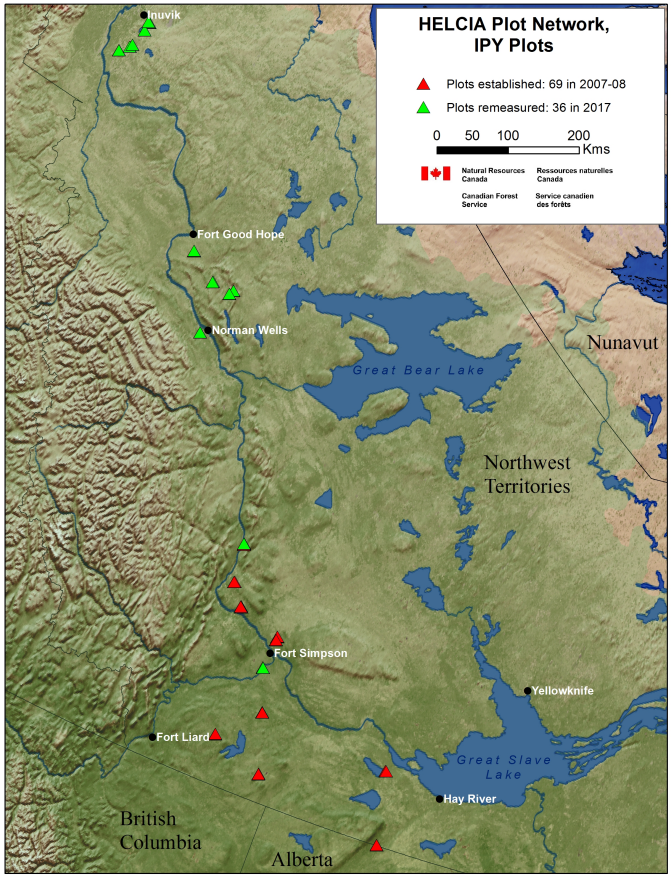
Airborne LiDAR

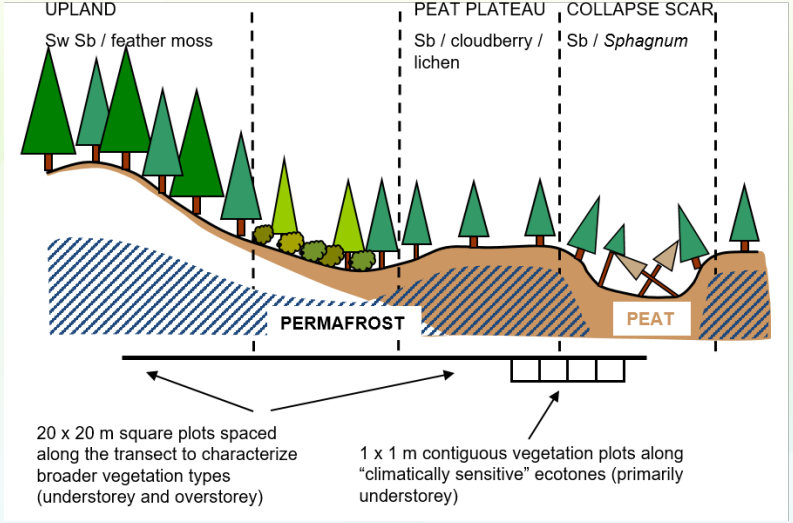
- Structural metrics at high resolution
  - Height
  - Density
  - Volume/basal area
  - Vertical or horizontal structure



Permafrost-Vegetation Change

Mackenzie Valley (IPY) Plots – Bhatti, Errington, Li





69 plots total (36 completed 2017, 33 completed in 2018)

Data currently being analyzed.

Canada

Mackenzie Valley (IPY) Plots
Forest Growth & Stock Changes

Mackenzie Valley (IPY) Plots Lichen Biomass

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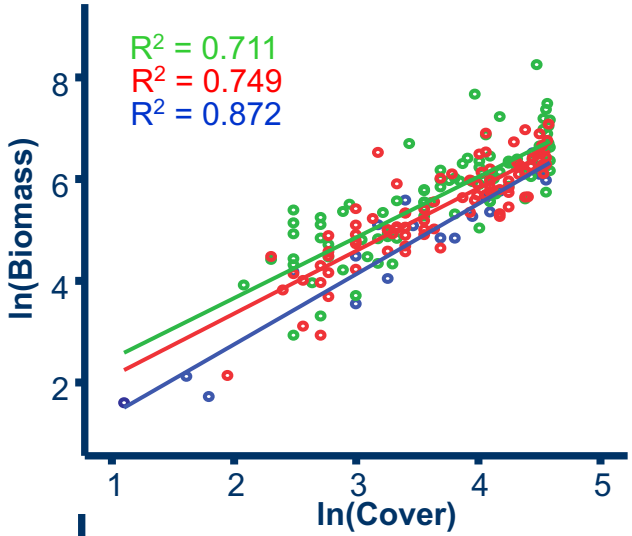
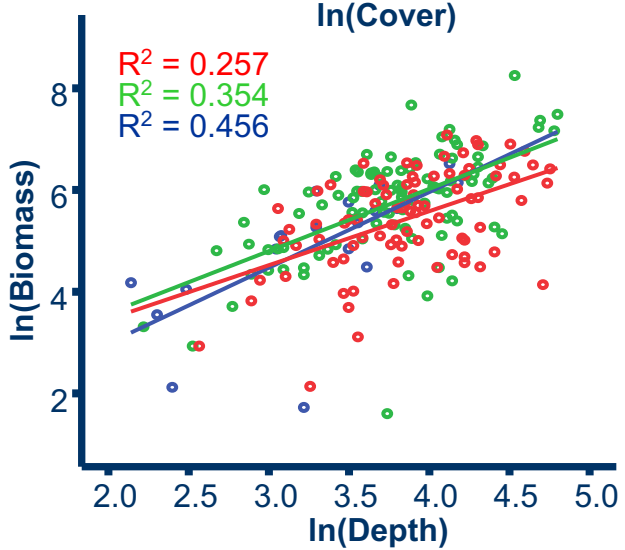
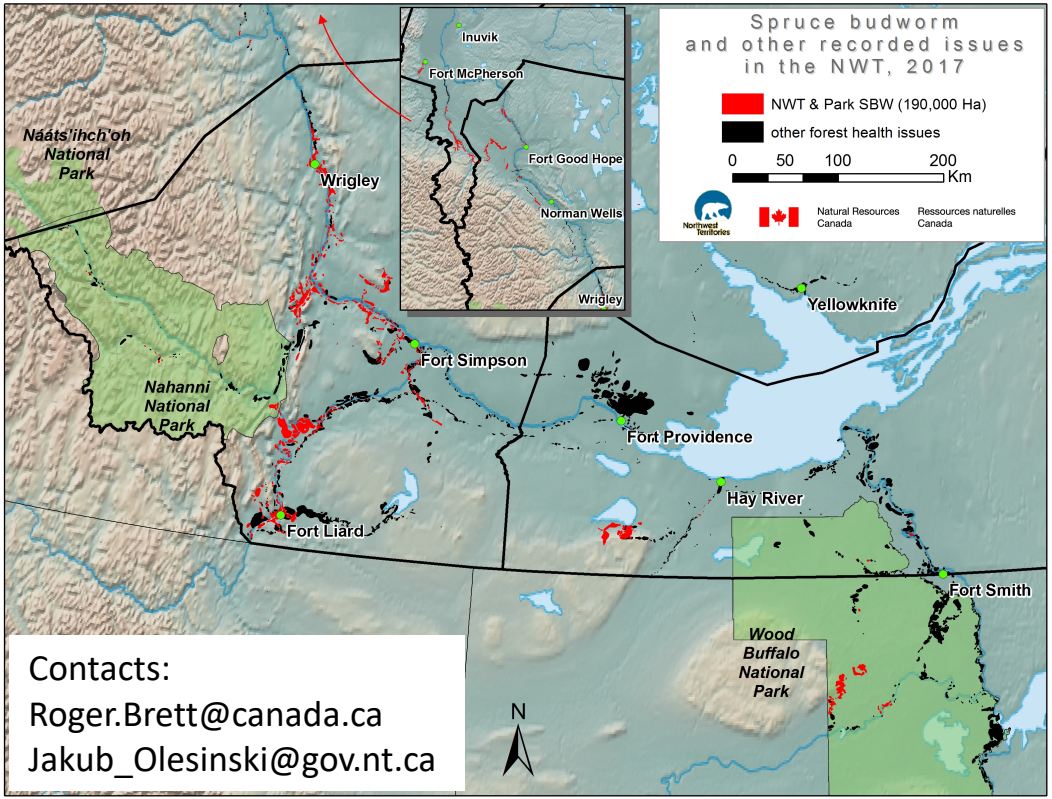
- Collapse Scar
- Peat Plateau
- Upland





Forest Health Monitoring in NWT and Wood Buffalo National Park (Roger.Brett@canada.ca)



Contacts:
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Photos by: Roger Brett

Continued CFS involvement in ABoVE

What about the worms?

The New York Times

'Earthworm Dilemma' Has Climate Scientists Racing to Keep Up

Worms are wriggling into Earth's northernmost forests, creating major unknowns for climate-change models.

Some Key CFS Contacts

- Jason.Edwards@Canada.ca – adaptation and decision-making (and primary contact for NASA ABoVE)
- Guillermo.Castilla@canada.ca- remote sensing
- Elizabeth.Campbell@Canada.ca – vegetation dynamics
- Ted.Hogg@Canada.ca – drought and vegetation change
- Dan.Thompson@Canada.ca – fire and peatlands
- Ellen.Whitman@Canada.ca – fire severity and recovery
- Kara.webster@Canada.ca – peatland carbon budget modelling (permafrost interests)
- Werner.Kurz@Canada.ca – carbon budget modelling
- Graham.Stinson@Canada.ca – National Forest Inventory
- Rob.Skakun@canada.ca – National Burn Area Composite
- Ruth.errington@Canada.ca – Mackenzie Valley Plots

Regional Integrated Assessments of climate change and forests (Edwards; Campbell)

- Building science-management partnerships
- Conducting a vulnerability assessment of GNWT forest resources and management in Dehcho; and Yukon/BC.
- Interdisciplinary approach to understanding and modeling climate change impacts and adaptation within northern forests.
- ABoVE partner project?